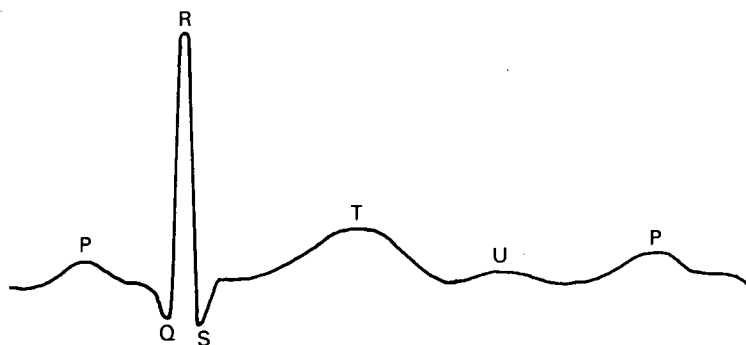


NASA TECH BRIEF



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Cardiac R-Wave Detector



EKG Input Waveform

The problem:

To obtain a reliable signal from a natural heart's systolic contraction in order to coordinate the action of a heart-assist device with the action of the failing natural heart.

The solution:

A cardiac R-wave detector (designed from aerospace controls systems technology) that processes the natural heart's electrocardiac signal in a sequence of operations which essentially eliminates all components from the input signal except the R-wave.

How it's done:

At the beginning of the heart's pumping cycle, the isometric contraction of the ventricular muscle mass generates a pronounced electrical signal known as the QRS wave complex of the electrocardiogram (EKG). The R-wave portion of the QRS complex can be detected and used as the reference signal for a heart-assist pump cycle. The cardiac R-wave detector obtains an input signal from surface electrodes attached to the patient's right arm and left leg and produces an electrical output pulse used to actuate a

heart-assist device. It does not require the use of blood pressure or pump pressure waves.

The cardiac R-wave detector processes the input signal in a sequence of operations which detects the R-wave in the presence of high electrical interference. All false signals except those generated by vigorous motion or extreme muscle tensions are rejected. In succession, the detector's electronic circuit rejects signals that occur equally from the two surface electrodes attached to the patient's body, attenuates low- and high-frequency components, rejects low amplitude signals, rejects short duration signals, and rejects signals during the pumping time of the heart assist pump.

Notes:

1. Advantages of this detector, compared to conventional detectors, appear to include: better discrimination between the R and T waves, generally better noise filtering characteristics, and flexibility in the polarity of the trigger pulse.
2. Details of design and operation are described in NASA Technical Memorandum X-1489, "Cardiac R-Wave Detector," by Vernon D. Gebben.

(continued overleaf)

3. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B68-10144

Patent status:

No patent action is contemplated by NASA.

Source: Vernon D. Gebben
(LEW-10394)